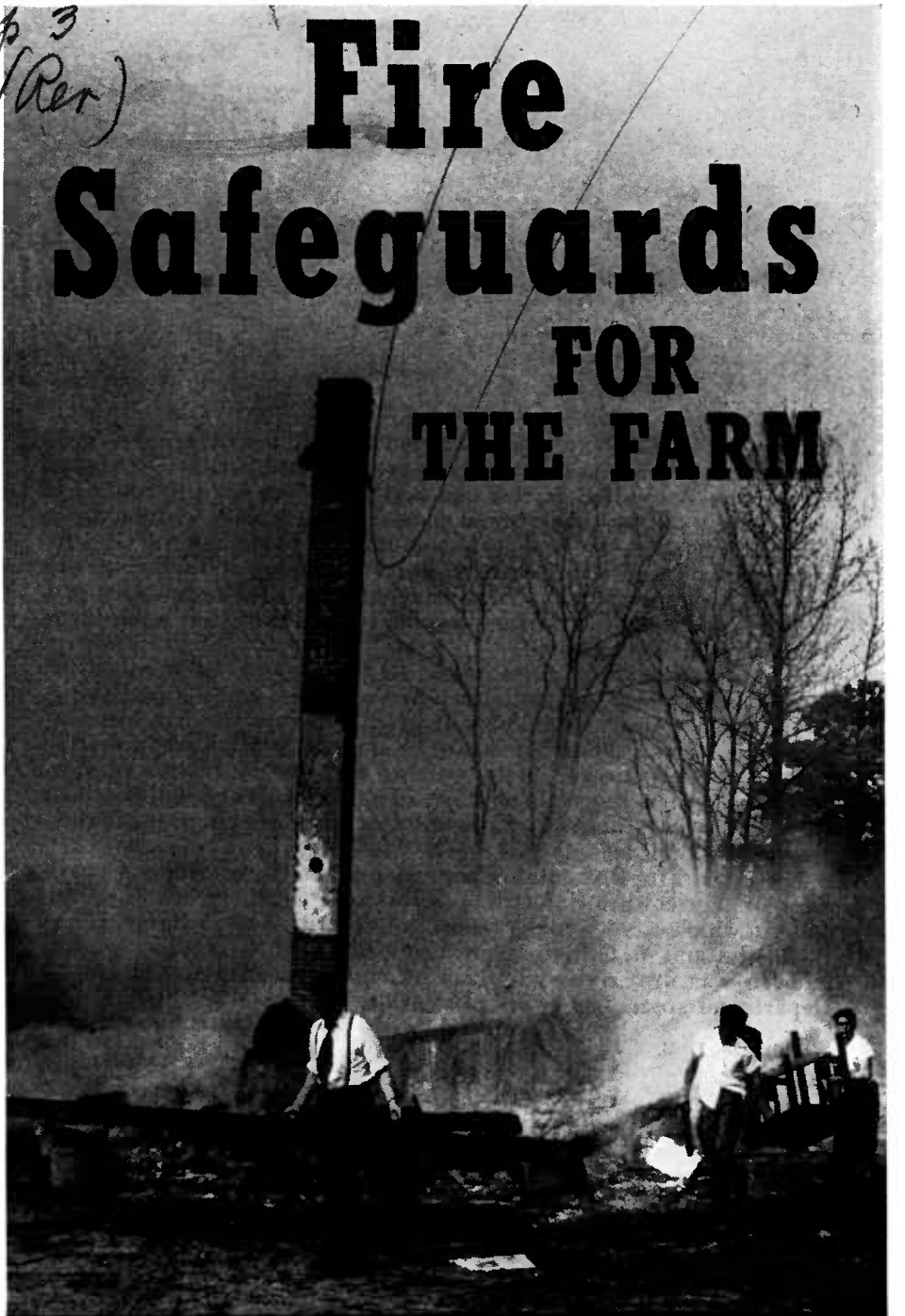
Fire Safeguards FOR THE FARM



Farmers' Bulletin No. 1643
U.S. Department of Agriculture

THIS BULLETIN tells how to lessen or avoid fire hazards on farms and thus add to the safety of both property and persons. It points out how an individual farmer can further reduce the probability of serious fire losses by using simple home equipment with which a fire in its beginning stage can be quickly put out. It points out the need for organized and well-equipped rural fire departments and tells how this need has been met in many rural communities. Such organized protection is necessary for farmers in order to hold the loss to a minimum whenever a fire gets a start.

Reasonable care and forethought in the removal of needless fire dangers, a fair degree of individual preparedness, and the availability of community fire protection will greatly reduce the fire losses on American farms. These losses now total about $100,000,000 a year.

Substantial reduction in the number and destructiveness of farm fires, which often destroy human life as well as property, will eliminate much unnecessary hardship and sorrow and will help to promote rural progress and well-being.

The Farm Fire Prevention Committee of the United States Department of Agriculture Safety Council assisted in the revision of this bulletin which was originally issued in 1930, with V. N. Valgren, Harry E. Roethe, and M. C. Betts (now deceased) as authors. The original bulletin was first revised in 1939 by two of the authors and other Department specialists in fire prevention.

Issued November 1930
Washington, D. C. Revised July 1949

FIRE SAFEGUARDS FOR THE FARM

By RALPH R. BOTTS, *Agricultural Economist, Bureau of Agricultural Economics*

CONTENTS

THREE KINDS OF SAFEGUARDS

THREE KINDS, or classes, of safeguards are required to make farm property reasonably safe from fire. By the proper application of these safeguards the annual farm-fire loss could be reduced $50,000,000 or more. Even this reduction would merely cut in half the annual loss of about $100,000,000. Students of fire prevention and protection are generally agreed that considerably more than half of the farm fires in any given year could readily be prevented. The fact that fires, both on farms and in cities, frequently destroy human life as well as property makes the problem of fire safety doubly important.

The **first** of these safeguards is the use of care and forethought in the construction, maintenance, and use of the property, including farm woods, with a view to eliminating all needless fire danger. The **second** is individual or home preparedness in the form of simple equipment for use in extinguishing fires before they reach a serious stage. The **third** is community preparedness, consisting of a fire-fighting organization equipped to check larger fires or to prevent their spread. Such an organization, with more effective equipment than an individual farmer can maintain, is needed to hold the loss to a minimum in those cases in which the first two classes of safeguards have failed, or threaten to fail.

These three classes of safeguards together make a triple line of defense against destruction by fire, each class supplementing the other

two. The order in which they have been given may be said to be the order of their importance as well as the order in which they should be applied. The first class of safeguards consists of means and methods of avoiding fire danger and is really fire prevention. The second and third are means and methods of fire fighting, or fire protection, as it is usually called.

Without care and forethought in prevention, fires are likely to be frequent and to spread so quickly that no form of protection will prevent severe losses. Without individual preparedness in the form of simple fire-fighting equipment, most of these fires are likely to be serious. Without community equipment and organization, a fire that is not promptly stopped by the use of home equipment is likely to destroy not only the building in which it originates but nearby buildings and other property, perhaps including the farm woods.

If the first and second of these sets of safeguards, or either one of them, could be made perfect, the need for the third—organized or community fire protection—would disappear. But such perfection has never been reached. Furthermore, it is admitted that complete fire safety through individual action or even through combined individual and community action will probably never be reached.

Reasonable preventive measures and reasonable preparedness against fires are all that can appropriately be recommended or practiced. Beyond that the measures for fire prevention and protection are unduly costly or burdensome. No one would recommend, for example, that heat and light be dispensed with in the homes because they cannot be made absolutely free from danger of fire, or that fire-fighting forces and equipment should be maintained by farmers on the same large scale that prevails in congested cities. With moderate and practical preventive measures the probability of serious loss by fire to an individual farmer can be greatly reduced. In fact, property and persons can be made reasonably safe against loss or destruction by fire without using extreme measures, and when these reasonable precautions have been taken by a community, the insurance against such losses should be obtainable at a very moderate price.

ESTIMATES OF FARM FIRE LOSSES

But how many of our farms or how many rural communities are now safeguarded against fire to a reasonable degree? The cost of fire insurance in many parts of the country and the estimates of our total farm-fire loss give a distressing reply. No complete or entirely reliable figures for our annual farm-fire losses are available. The most reliable estimates are probably those prepared by the Bureau of Agricultural Economics, United States Department of Agriculture, based on the insurance experience of farmers' mutual fire insurance companies. These estimates have varied from $68,000,000 in 1937 to $99,000,000 in 1948. (These figures have been approved by the Committee on Farm Fire Protection of the National Fire Protection Association.)

Commercial farm-insurance rates for limited parts of the country reach $2 per $100 a year, under certain conditions. Even for sections or States in which fire insurance in farmers' mutual companies can be had at an average cost of about 20 cents per $100 per year, and in which commercial rates are only moderately higher, there is good

reason to believe that the farm-fire losses are fully twice what they would be if reasonable safeguards were used by all farmers. Here, as in districts less fortunate from a fire-loss standpoint, the added personal safety and the removal of much of the trouble that fires usually bring in addition to the direct fire loss, would be a gain as important as the savings from lower cost of insurance.

REDUCTION OF FIRE DANGER ON FARMSTEAD

In the first class of safeguards, or measures for doing away with fire danger, the points are considerations of safe construction, proper maintenance, and caution in the use of heating, lighting, and other equipment and materials that involve danger to property and life.

CONSTRUCTION AND MAINTENANCE OF BUILDINGS

Location of Buildings

The first question in connection with the construction of a building is its location with reference to other buildings on the farmstead. The barn, or barns, in which hay and straw are stored and used, and about which some litter is generally unavoidable, should usually be separated from the dwelling, where fire is regularly used, by at least 100 feet. A clear space of 150 feet is generally believed to give practical security from exposure fires. Where other considerations make such spacing of the buildings impossible or inadvisable, special attention should be given to other protective measures, such as the use of noncombustible or fire-resistive construction materials, particularly in connection with roofs.

Another important consideration is to so place the main buildings, particularly the dwelling and the barn, that the prevailing winds in the locality blow at right angles to a line connecting these buildings, rather than parallel to such a line. If the dwelling and barn are so placed that the prevailing winds blow along the line connecting them, the fire hazard is considerably increased. With a strong wind blowing from the dwelling to the barn, there is the danger not only that the burning of the dwelling would endanger the barn but also that on some dry and windy day sparks from the chimney may set fire to the barn. With the wind blowing from the barn to the dwelling, the main danger is that if the barn should burn, the dwelling would be endangered by the strong heat and the flying sparks that are characteristic of a barn fire. The result might be a disaster such as that pictured in figure 1. In addition to the fire hazard, a farm lay-out in which the prevailing winds blow from the barn or the hoghouse to the dwelling is objectionable because the dwelling will be needlessly subjected to disagreeable farmyard odors.

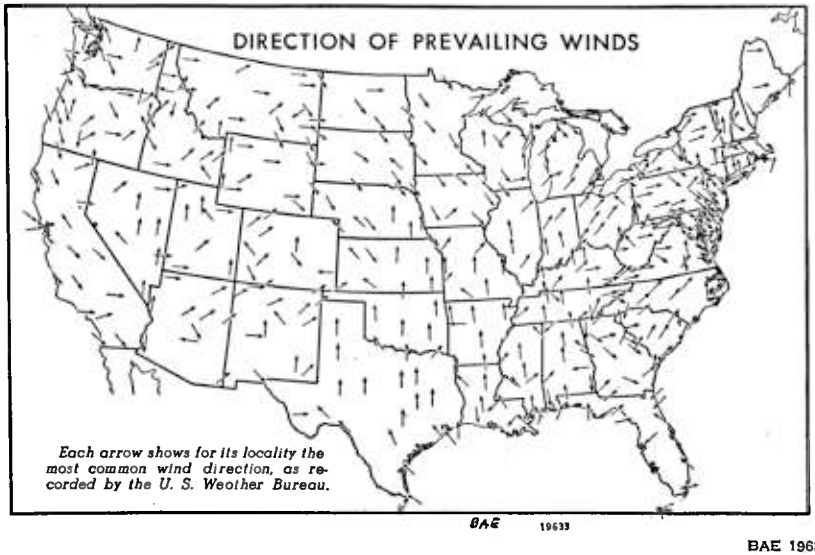
In few, if any, localities is the wind movement consistently from any one direction, or along a given line. Regardless of how the buildings are placed with reference to one another the wind direction at times will be either directly from the dwelling to the barn or from the barn to the dwelling. But in practically all sections there is a prevailing wind direction. To ignore this fact is to increase the danger of serious loss from fire and the possibility of other discomfort. In a given locality, for example, the prevailing winds may be from northwest to

BAE 13657–FM

FIGURE 1.—Farm fires often leave only ashes and scrap iron.

the southeast, or the reverse, fully three-fourths of the time. In such a locality the farm lay-out should, if practicable, place the barn either northeast or southwest of the dwelling.

The prevailing wind directions in all parts of the United States are indicated in figure 2. The arrows indicate, for their respective localities, only the wind direction that prevails to a greater extent than



BAE 19633

FIGURE 2.—Wind direction should be considered in planning a farm lay-out.

does any other. In many cases, the second most common wind direction is the point of the compass opposite that representing the most common or prevailing direction. If the farm lay-out, therefore, is so planned that the line connecting the main buildings is about at right angles to the line of the more common wind directions, the times when the wind blows either from the barn to the dwelling or from the dwelling to the barn will not be often.

It is impracticable, in this bulletin, to give facts regarding the wind directions for all localities, but more complete information can easily be obtained. The United States Weather Bureau has section centers or regional head offices to which the local stations send their data. These section centers are located at the capitals of the respective States except as indicated in the accompanying list.

State	*Weather Bureau section center*
California	San Francisco.
Delaware	Baltimore.
Florida	Jacksonville.
Kentucky	Louisville.
Louisiana	New Orleans.
Maryland	Baltimore.
Minnesota	Minneapolis.
Mississippi	New Orleans
Missouri	St. Louis.
Nevada	Salt Lake City.
New England (all six States)	Boston.
Oregon	Portland.
South Dakota	Huron.
Texas	Houston.
Utah	Salt Lake City.
Washington	Seattle.
West Virginia	Parkersburg.
Wisconsin	Milwaukee.

By writing to the United States Weather Bureau Office at the capital city of the State, or, for the States listed, at the city named, anyone can get further information on the wind directions for his locality, including the direction of the prevailing wind and the percentage of the time that the wind comes from each of the most used points of the compass.

Roofing Material

The kind of roofing material to be used is particularly important in the construction of dwellings. Other buildings may shelter animals and other valuable property. The dwelling shelters the family. Heating apparatus is an essential part of the home, but effective spark arresters are not usual on farm dwellings. So it is probable that sparks will sometimes fall on the roof.

Letting soot accumulate in the chimney adds greatly to this danger. Especially on days of high wind and strong draft this soot is likely to ignite and temporarily turn the chimney into a roaring furnace. In any case, if fire should originate in some other building, the roof of the dwelling may be exposed to flying brands. The value of noncombustible roofs was clearly demonstrated by the great forest fires in Maine in October 1947. Sparks, showered from fires considerable distances away, often did no damage to buildings that had sheet-metal or composition roofs, while other buildings in the same locality with wooden-shingle roofs were burned.

A substantial roof[1] of tile, slate, metal, or other noncombustible, fire-resistive or fire-retardant roof covering of the better grades, may cost somewhat more at first than one of wooden shingles or of thin roll roofings, but it adds substantially to safety from fire. It also

[1] See Farmers' Bulletin 1751, Roof Coverings for Farm Buildings and Their Repair.

lessens the possibility of flying brands that might set fire to nearby buildings if the dwelling catches fire.

If wooden shingles are to be used, poor grades should be avoided, particularly for buildings that have heating plants, and the best grade of edge-grain shingles should be used for the more important buildings. They should be put on satisfactorily, with plenty of overlap, so there is less chance of their curling and getting ragged in a short time. Flimsy and cheap grades of manufactured roofing should be avoided even though they may be more-or-less fire resistant while they are in good condition.

For all kinds of roofing material, the cost per year of service, rather than the first cost, is the real test of economy. The danger that chimney sparks, or brands from a nearby fire, may ignite a roof that is covered with dry wooden shingles is greatly increased when the shingles are old, frayed, and warped. Roofs of other material if in poor repair also increase the danger of fire. Dilapidated roofs on dwellings should be replaced or recovered not only to give renewed weather protection, but to remove a serious fire hazard. In the event of fire, a noncombustible roof has a blanketing effect, which prevents updrafts. Updrafts intensify fires and throw burning embers into the air, and the embers endanger nearby property.

Chimney and Flue Construction

Defective chimneys are one of the most frequent causes of fires in dwelling houses. The construction of the chimney deserves special attention. Under no circumstances should the effort to avoid a slight expense be permitted to make a home a firetrap. For safety in chimneys, substantial masonry is necessary, and this should always rest firmly upon rock or hard clay and not on brackets or on any part of the building, unless a substantial cellar wall is considered such a part. All new chimneys [2] should be built with sound walls at least 4 inches thick if brick or reinforced concrete is used, and not less than 8 inches for hollow tile, and 12 inches for stone construction. All such chimneys should be lined with flue linings of fire clay or vitrified clay. No woodwork should be built into or be in direct contact with the masonry of any chimney. A clearance of at least 2 inches between chimneys and flammable material is recommended. The space should not be filled in except partially, as needed for fire stopping around the chimney. This can be done with mortar or plaster held by strips of metal lath or wire fabric secured in the opening.

Patented flues can now be bought, as a substitute for masonry chimneys, for use in connection with all fuels. They are of metal outer construction with various inner linings, and are easy to install, relatively safe, and efficient as draft producers.

Chimneys disintegrate most quickly at the top, owing to the combined action of weather and hot gases. Lime mortar in the joints and soft brick are soon affected, so that wide cracks are formed, permitting the passage of sparks. Such a condition is frequently found in old chimneys to a point well below the roof. It is a source of great danger. Small cracks may be filled with good mortar consisting of one part portland cement, one part hydrated lime or slaked-lime putty, and

[2] See also Farmers' Bulletin 1889, Fireplaces and Chimneys.

six parts of clean sand. If there are many cracks or if the bricks are eaten away, the chimneys should be torn down to the solid construction and rebuilt with hard-burned brick and mortar, mixed in these proportions. A crack in a chimney may be found by building a smudge in the fireplace or stove and covering the top of the chimney with a board or wet sack. Escaping smoke will then quickly reveal any crack or cracks in the chimney walls. It is a good idea to inspect chimneys, particularly at the roof line, in the fall of the year. Entry into the attic is necessary if a thorough job is to be done.

Fire Stopping

In the construction of walls of the dwelling the question of fire stopping should be considered. By fire stopping is meant particularly the closing of all open spaces in hollow walls at the floor line so that fire will not pass quickly from the basement to the house above, or from one story to another. The added cost is small in comparison with the added fire safety.

Open stairways are a source of danger because when a fire has started in the cellar or lower floor of a house they may act as passageways for the fire and may soon become impassable. Loss of life in farm fires and injuries suffered in trying to escape are often so caused. The victims are trapped on an upper floor. A second stairway in another part of the house or a porch deck or roof onto which the family may escape may mean the difference between safety and serious injury or death.

Many of the precautions recommended for dwelling construction apply also to barns. The least that should be done is to provide a substantial floor over the stock, if hay is stored above, to prevent rapid burning through, if the hay should catch fire. This will increase the chance of saving valuable stock. All hay chutes and stairways should be closed lest a fire below spread rapidly to the hay above, or burning hay from the mow drop into the stable below.

The specific suggestions regarding fire-protective construction on the farm, given in Farmers' Bulletin No. 1590, should be of much value whenever important alterations are to be made or new buildings are to be erected. A copy of this bulletin may be had free if a request is mailed to the United States Department of Agriculture.

Lightning Protection

Protection against lightning is important, as lightning is one of the more frequent causes of fire in farm buildings, in most parts of the country. Excepting possibly a few localities in the far West and especially in the Pacific Coast States, where the lightning hazard to farm property is unusually slight, no farm building of substantial value should be considered actually completed until it has a standard system of protection against lightning. Some individuals still question the value of protection from lightning by means of a system of grounded conductors or by the proper grounding of substantial metal roofs, but the evidence of the value of such protection leaves no reasonable room for doubt. In the North, where the barn is usually the highest farm building, it is perhaps even more necessary to put rods on the barn than on the house.

846174°—49——2

The lightning-protection system should be inspected at least once a year, and particular attention should be given to the rods at the points at which they enter the ground. It is here that corrosion of the down conductors is most likely to be found. Mechanical injury to the rods also is likely at or near the ground. The conductor should be put in a pipe or enclosed by some protective sheathing, from about breast high to the ground, to prevent damage caused by livestock rubbing directly against it. This is particularly necessary if conductors are located at or near the corners of buildings. The conductor should go 8 or 10 feet into the ground, or farther if necessary to reach moisture.

All who have looked carefully into the question of the value of protection from lightning agree that, when applied according to accepted modern methods and standards, it has a high degree of efficiency. This efficiency has been calculated as ranging from about 85 percent to 98 or 99 percent, the higher figures applying to systems that comply with present standards. A 98-percent efficiency in this case means that the probability of loss or damage from lightning is so reduced by the protective system that only two cases of damage from lightning actually occur to protected buildings for each hundred cases of damage that occur to the same number of unprotected buildings under the same general conditions. A lightning rod, properly installed and kept well grounded, not only protects the building and its contents, but may save human life. The proper grounding of a metal roof is believed to provide almost equal protection, particularly in the case of a barn.

Electrical Installations

When properly handled and used, electricity is one of the safest and most convenient, and often the cheapest, source of light, heat, and power. But electrical installations may mean serious fire hazards unless the wiring is adequate and safe, and unless the selection, installation, and operation of the equipment is done with great care. With the increased use of electrical apparatus, many wiring systems, though adequate when first installed, have become unsafe through overloading and additions that have been made.

All wiring should be installed in accordance with the provisions of the National Electrical Code and State or local regulations. It should be approved by a thorough, conscientious, and expert inspector. Prompt and proper repair of faulty wiring is essential to the continued safe operation of any farm installation. Motors and other (new) electrical equipment which bear the seal of the underwriters' laboratories are safe when used as the manufacturers intended. They should be installed and used in accordance with the National Electrical Code and the manufacturers' instructions. It is especially important that any electrical apparatus that is installed in damp places or near flammable material or in other hazardous locations be inspected by a qualified person to make sure that safety practices have been followed.

One of the most serious fire hazards is the use of improvised fuses or fuses of too great amperage. This permits the wires to carry so much current that they may overheat. If the fuse is oversize for the circuit, it may mean an immediate fire. But more commonly the wires merely warm to the point where the insulation on them deterio-

rates, and a long time—maybe years—later, it falls off. Adequate wire sizes and enough branch circuits, properly arranged, will provide capacity for operating the equipment without overloading. Circuit breakers are widely used in place of fuses. They break the circuit automatically, if the wires are overloaded. They are permanent, not requiring replacement when they trip, and are easily reset. As they do not offer the temptation to put in oversize ones and as there is no replacement cost, they are to be preferred to fuses. A fuse of more than 15 amps should never be used in a circuit to which lighting fixtures are connected. Branch circuits on which motors are operated should be equipped with "time-lag" fuses or circuit breakers, since motors in starting often "blow" fuses that are of ample size when the motors are running up to speed. The delayed action of a time-lag fuse and of a circuit breaker allows the motor to start and still gives protection against currents that would overheat the wires.

Frequent inspection of cords or portable appliances and repair or replacement of those damaged or worn out will greatly reduce the fire hazard from wiring installations that are otherwise in good condition. Many disastrous fires have been started by careless handling of irons and other heating devices. With the current on, many such devices become hot enough to ignite wood and other flammable material. Accumulations of dust on bulbs have been known to cause barn fires. Some farmers avoid this by enclosing their bulbs with glass jars.

HAZARDS AND DANGERS FROM CARELESSNESS

Very many farm fires are due to carelessness in the placing and in the use of heating and lighting equipment. Thousands of farm homes and hundreds of lives are lost each year because of lack of care and forethought in the selection, installation, placement, and operation of stoves, lamps, and other heating and lighting apparatus. Too many times we know of these hazards but continue to take chances—putting off the removal of a hazard until it is too late.

Stoves and Furnaces

Stoves and furnaces should be put up solidly and should be so placed that the heat from them cannot ignite nearby walls or woodwork of any kind. If the room is such that it does not permit placing the stove far enough from the walls to avoid danger to exposed woodwork, the wall should be covered with sheets of metal or asbestos arranged with 1-inch spaces to provide an additional air space between the combustible material protected and the stove. A substantial metal or asbestos covering should also be placed under the wood or coal-burning stove, and this should extend well out beyond the edge of the stove, particularly on the side containing the door to the firebox, from which burning embers are likely to fall.

Stoves or furnaces should be of such size that enough heat can be generated to keep the house at the proper temperature even in cold weather without crowding or overheating them. This precaution adds greatly to the life of the apparatus as well as the fire safety of the dwelling.

Stoves and pipes, as well as chimneys, should be cleaned from time to time by removing all accumulations of soot. In the absence of any

better device for sweeping the chimney, a bundle of twigs or branches of evergreen tied to a rope will do fairly well. Even a bundle of coarse hay, the wisps of which are well twisted together, makes a usable brush for sweeping the chimney. Specially constructed wire-brush chimney cleaners can be bought.

Stovepipes

Stovepipes should enter directly into the chimney without passing through walls or partitions. If a house is so constructed that the chimney cannot be reached without passing the stovepipe through a wall except at considerable expense, a ventilating thimble should be used. This thimble greatly reduces the danger of fire from an overheated pipe, for air circulates through the open spaces in the thimble on all sides of the pipe and carries off much of the heat. In installing the thimble, the woodwork first should be cut away so that the clearance between stovepipe and the nearest combustible material is not less than the diameter of the pipe. Then the ventilating thimble should be so installed that the stovepipe is centered in the opening. Smoke pipes should not pass through floors, closets, or other concealed spaces as that often results in fires which are not discovered until they have gained headway. There should be at least a 10-inch clearance between a stovepipe and a flammable ceiling. If there is no flue or chimney into which the stovepipe can be inserted and it is necessary to put the stovepipe through the ceiling and roof, a good "roof jack" should be used which has a minimum clearance of 1½ inches between the inner pipe and the outer jacket in the case of a vertical installation.

Fireplaces

Open fireplaces have always been favored by many. Unprotected fireplaces may involve a considerable danger, however, especially in homes in which there are small children. Besides the danger from flying sparks, clothing may be set afire by close approach to the flames, and children at play may fall into the fire. A substantial screen should always be used before a fireplace that is in use, to avoid danger to the furnishings as well as to persons.

Oil Stoves

Oil stoves for cooking, and sometimes for heating, are found in many farmhouses. Most of these stoves burn kerosene, but others are constructed for burning gasoline. Oil stoves are dangerous unless used with great care, and those that burn gasoline require even greater caution. Pots boiling over have caused oil stoves to flare up and so start fires.

Lamps

Oil lamps will probably continue to be used for some time on farms notwithstanding a constant increase in the number of farm homes being provided with more modern lighting systems. All oil lamps intended to stand on tables or desks should have a relatively wide base so they will not easily be tipped over. A metal lamp has an advantage over a glass lamp in that if it should be accidentally tipped over or dropped to the floor, it will not break, and so is not likely to flood the

room with burning oil. Gasoline lamps are sometimes used; they give added possibility of serious accidents unless handled with special care.

All oil lamps, as well as oil stoves, should be filled by daylight. Even then, the filling should always be done well away from a heated stove or a flame of any kind. The oil chamber should never be poured so full that there is not ample room for the slight expansion of the oil that comes from the heat of the lighted wick. If the lamp is so full that the oil comes almost up to the flame the expansion may cause an overflow of burning liquid that endangers both the family and the house. Lamps should never be placed on rickety boxes or stands but only on solid tables or furniture. They should be placed well away from the edge, so they will not be tipped over and thrown to the floor.

Kerosene to Quicken Fire

The use of kerosene to kindle or quicken fires in stoves or furnaces has caused many disastrous explosions and fires. If the stove is still warm from the last fire, or if a smoldering fire is in the stove at the time kerosene is poured on, the danger is particularly great. Fumes from the kerosene may cause an explosion which could be fatal, and spread a fire beyond hope of suppression. The reports of the State fire marshals have many specific and often gruesome warnings against the use of kerosene to quicken fires.

Gasoline

Gasoline should not be used for any other purpose than as a motor fuel. A tractor, automobile, truck, or any other piece of motorized equipment should not be refueled while the engine is running. Spilled gasoline on a hot engine is extremely dangerous. And, to prevent accidents, rubber-tired tractors doing belt work should be grounded to relieve the accumulation of static electricity. Overheated engines and unprotected exhaust pipes on harvesting equipment have started many field fires. Another thing: If it is absolutely necessary to use a lantern in the barn it should be hung up, out of the way, in a safe place. It should not be set down.

Gasoline in large quantities, if outside of special storage area, should be stored only in underground tanks from which it is pumped as needed. To store gasoline on the premises in other ways, as in surface tanks, involves considerable possibility of accident. If it is done, the dangers should be fully recognized and guarded against by every practicable safety measure. Surface storage tanks should be 75 feet from the nearest building, on the downward slope and be encircled with a dirt trench. It is reckless to store gasoline inside any farm buildings. The vapors from this liquid are heavier than air and are likely to form first along the floor. A room may contain considerable gasoline vapor before it is perceptible to a person in the room; a flame or a spark may cause an explosion before the vapor is noticed. When gasoline is being handled or poured, no open flame nor smoking should be permitted nearby. All portable containers for gasoline should be of the safety type and painted a bright red and they should be distinctly labeled Gasoline.[3]

[3] See Farmers' Bulletin 1678, Safe Use and Storage of Gasoline and Kerosene on the Farm. See also, Standard for Farm Storage of Flammable Liquids, adopted by the National Fire Protection Association, 1947.

Bottled Gas

The use of bottled or liquified petroleum gas for cooking and other purposes is increasing rapidly in many rural sections. Bottled-gas installations should be made in accordance with the requirements of the Underwriters' Laboratories and any local ordinance effective for that type of fuel. The instructions furnished by all distributors of such fuel should be followed by the user. As this type of gas settles toward the floor, it creates a hazard that is not associated with the gas ordinarily used by city people.

Acetylene

Acetylene generators are not recommended for farm use.

Incubators and Brooders

Flame-heated incubators and brooders carry an element of danger. The fact that they are left burning unattended for long periods in a place where there is combustible litter makes the danger of destructive fire greater than in the case of oil-burning equipment in the homes. The barn is usually one of the worst places for flame-heated incubators. If possible, they should be operated in some smaller detached building or shed where, if there should be a fire, the loss may be held to a minimum.

Do Not Use Gasoline for Cleaning

Gasoline should be used only as a motor fuel. Its use for cleaning involves grave hazards. Many fatal accidents have come from gasoline cleaning. Indoors the danger is particularly great, because the vapor from open gasoline containers, or from garments saturated with this liquid, is confined, and may cause an explosion if a spark or flame of any kind comes in contact with it. The mere rubbing of silk fabric or the repeated dipping of woolens may produce a spark that will ignite gasoline vapors. The use of benzene or naphtha for cleaning is about equally hazardous. Many safe cleaning fluids that will neither explode nor burn are available. The safe practice is to use only such nonflammable cleaning fluids.

Matches

Matches are one of the greatest conveniences of civilized man, but their very convenience and the ease with which fire may be produced any time and anywhere lead to many accidents and destructive fires. Matches are especially dangerous in the hands of children and are a serious menace to them as well as to property.

The match that involves the least danger of accidental fire is the well-made safety match that will ignite ordinarily only when rubbed upon the specially prepared surface of the side of the box. It does not ignite when accidentally stepped upon or crushed. When match stems are made of straight and firm wood, there is less danger that the stem will break when the match is struck, and that the burning head will set fire to clothing or other material it falls upon. Especially on farms, it seems advisable to use only good grades of matches which can be ignited only when struck on the box. Any other kind

may cause a fire by being dropped accidentally in hay and litter and becoming ignited by friction caused in some unexpected way.

Regardless of the kind of matches used, they should be kept out of reach of small children. A metal or glass container for the partly burned match stems should be kept near the stove or other place where matches are regularly used.

Careless Smokers

A careless smoker with his matches is often as great a danger to property as is a child with matches. This danger consists in the lighting of matches and in throwing them away before they are completely extinguished and in the accidental dropping of matches in dry hay or litter where they may be ignited later acci-

FIGURE 3.—A barn fire spreads rapidly and unless extinguished before it has a real start, the building and adjacent property are likely to be doomed.

dentally. The cigar butt, and particularly the cigarette butt, that is thrown away while still burning is a dangerous fire menace. They have been responsible for many fires in buildings as well as in forests and fields when grass and leaves are dry. Smoking in or about a barn or other outbuildings that contain combustible material should not be tolerated. The result may be a scene such as that shown in figure 3. A firebreak (see fig. 7) plowed around a field of dry grain or hay, particularly if the field is next to a highway, should help to prevent the spread of any fire.

Disposal of Ashes

Careless disposal of ashes from stoves or furnaces has caused many farm fires. Even when the ashes recently shaken from the firebox seem to be dead, they may contain live coals which a wind may scatter

in dry grass or litter and fan into a flame. Unless metal containers are available to hold the ashes, care should be taken to see that the ashes are actually dead before they are thrown out and left unguarded. This is particularly important in dry seasons. Safety suggests that loose ashes should never be dumped near the house.

Accumulation of Rubbish

Accumulations of rubbish in attics, cellars, or other storage places add to the fire hazard of a building. They aid the spread of a fire and hinder putting it out and they may even be directly responsible for starting a fire if there are oily rags among the rubbish, or if matches should be accidentally dropped and later ignited among the trash. Oily rags sometimes create spontaneous combustion and, when left on barn floors, frequently contribute to fires, particularly in connection with power machinery that is operated in the barn.

The easiest way to dispose of most kinds of rubbish is to burn it in an incinerator or to pile it at some distance from the house and set fire to the pile. But in so doing care is necessary to see that buildings and other property are not endangered. Such fires should never be started on a windy day. Even on a still day the fire should be watched, until the blaze and even all smoldering embers are dead. No grass or weeds should be allowed around buildings, as any fire may travel along them. Dry vegetation, if next to the barn or along fence rows leading up to the barn, is particularly hazardous.

Christmas Trees

Christmas trees are usually associated with happiness and good will, but, occasionally, through carelessness and fires, they have brought disaster and sorrow. Using water is a good way to reduce the fire hazard of Christmas trees. Here are simple directions: Get a tree that has been cut as recently as possible. Make a fresh cut, diagonally with a saw, about an inch above the butt cut, then stand the tree in a container of water. If necessary to store the tree before Christmas, sprinkle it daily with fresh cold water and keep it in a cool, shady place. In setting it up indoors for the holiday season, use a stand that has a container for water. Check the water level daily because a tree of average Christmas-tree size may "drink up" several cups of water every day when it is in a heated room. The fire hazard is reduced and there is a noticeable fragrance from the tree.

Open flames, as from lighted candles, should not be permitted on or near Christmas trees. Dependable electrical lighting and decorative lighting outfits should be used instead. Electrical cords and connections should be kept in first-class condition and the circuits must not be overloaded. Decorations should be of noncombustible material.[4] It is advisable to keep from having much wrapping paper around the tree.

---

[4] See Technical Note 250, Treating Spruce and Balsam Fir Christmas Trees to Reduce Fire Hazard, Forest Products Laboratory, Madison, Wis., and Farmers' Bulletin 1786, Fireproofing Fabrics.

Spontaneous Ignition of Hay

Storage of hay in barns before it is well dried has caused many barn fires through spontaneous heating and ignition (fig. 3). Cured hay, which after storage has become wet from rain coming through a leaky roof or from floodwaters, also will heat and may ignite. Alfalfa, clover, and soybean hays with heavy stems that retain considerable moisture after the leaves seem to be dry are most likely to heat severely and cause a fire. Even though heating may not result in a fire, the hay undergoes a loss of nutrients that greatly lessens its feeding value.

Losses from fire and spoilage can be prevented by curing all hay thoroughly before storing it and by guarding against later wetting. To use a motor-driven fan to finish curing hay in the mow reduces the danger of overheating or spontaneous ignition. It is dangerous to place even small quantities of undercured hay in the mow, even though the remainder of the lot is well cured, unless a safe mow-curing system is being used. If in certain seasons the proper curing and drying is made difficult or impossible by frequent rains, it is safer to stack such hay in the field than to place it in the barn.

Frequent examinations should be made for several weeks after hay has been stored to learn the general condition of the hay. "Steaming," irritating odors, wet areas, and flues in the hay are dangerous signs of severe heating. If these conditions continue, the nearest fire department should be called on for help. A probe for testing temperatures in mows may be made by dropping a thermometer, tied to a string, down a pipe which has been inserted in the hay. Mows of excessively hot hay should be removed from the barn, but first the heating areas should be thoroughly wet with water and provisions should be made for fighting a possible fire, as the hay may burst into flames when uncovered or exposed to the air. Dry ice should delay ignition when heated hay is being removed from the mow. The removed hay should be taken to an open field because it may ignite later.

Many farmers put salt on damp or undercured hay to prevent spontaneous ignition. Although a liberal use of salt may retard fermentation, there is no evidence that the addition of salt to hay as it is stored, at least in quantities safe for feeding, will prevent spontaneous ignition. Until this question can be definitely settled by further experiments too much reliance should not be placed on salting, and it should not be considered a substitute for sufficient curing of hay in the field.

SOME MECHANICAL HAZARDS

Drying With Artificial Heat

Use of corn and hay driers and other feed and seed dehydrators may introduce special hazards when artificial heat is used. Losses by insurance companies from the use of corn driers have been reported as extremely heavy in some areas. Unfortunately, many farmers do not know that their insurance policies do not cover fire loss that comes from operating hot-air corn driers, or any other equipment which materially increases the hazard, without a special permit which is obtained at extra premium cost.

846174°—49——3

It has been recommended that dehydrators should be approved by a testing laboratory as a whole unit, rather than by parts, and that a unit should be large enough to do its job without using maximum temperatures. It should be located away from other buildings and should have automatic controls which will stop the flow of fuel if the burner flame goes out; or which, in the case of excessive heat, will stop the burner but still permit the blower to continue.

Hand-Fired, Forced-Air Furnaces

The principal danger in connection with such units as hand-fired, forced-air furnaces arises from insufficient cold-air return when the fan is stopped by fan-belt breakage, motor failure, or power failure. With no air to carry away the heat, stack temperatures get dangerously high. Mechanical protective devices are available through which there is thermostatic control over the opening and closing of the ash-pit damper. Excessive temperatures cause the damper to close, thus checking combustion.

HOME FIRE-FIGHTING EQUIPMENT

To be of real value, home fire-fighting equipment must be kept in a handy place and in condition for instant use. Its successful use depends upon early discovery of the fire. Attic and roof fires are so common and difficult to put out (fig. 4) that the attic or any space under the roof over the top story should be made accessible for fire-fighting. This is particularly necessary on farms because frequently there is no grown person at home except the farmer's wife.

LADDERS

Many roof fires are caused by sparks from the top of the chimney or openings in its sides. A ready means of reaching the top of a roof has saved many a building. The results shown in figure 4 might have been avoided had the dwelling been provided with ladders. The appearance of buildings is sometimes marred by attaching fire ladders, but in many instances the ground ladder can be located inconspicuously and the roof ladder may be merely a narrow board having a few small cleats. Instead of attached ladders it is well to have two light, strong, portable ladders, one of which has a large hook for hooking over the ridge pole. Householders should be sure ladders are in the best of repair and long enough to reach the highest farm building. Fighting fire from ladders and roofs involves enough danger without the risk of using defective ladders.

FIRE PAILS AND BARRELS

Many small farm fires are put out with the use of a few pails, pans, or dippers of water. The water should be thrown so as to drench the burning material. If the water is directed toward the top of the flame most of the water is likely to be wasted.

A fire pail usually holds about 12 quarts. It is a good plan to paint the outside of the pails red and stencil FOR FIRE ONLY on them in large black letters. Flat-bottom and cone-bottom pails are in use, but the latter are favored because they do not stand alone and therefore are

less likely to be used for other purposes. One pail to each 400 or 500 square feet of area to be served is generally enough. The pails should be hung from hooks or brackets or set on shelves 2 to 4 feet from the floor.

Pails are not enough because of the tendency to use them for other things, the failure to keep them filled, the limited water that can be kept in the relatively few pails usually owned, and the difficulty or impossibility of reaching fire within flues, partitions or walls, or on high ceilings, or roofs. Then there is the question of evaporation, freezing, or stagnation of the water and the unsightliness of the pails. Tight, but easily removable, covers or lids will lessen evaporation, and 3 to 6 pounds of common salt or calcium chloride dissolved in each pail will usually prevent freezing. A brine of this strength will retard or prevent objectionable odors and the breeding of mosquitoes.

BAE–20599

FIGURE 4.—A total loss from chimney sparks on the roof was averted by the timely aid of neighbors with simple home fire-fighting equipment.

Storage of water in casks, barrels, or tanks adds much to the value of pails for fire fighting. Old oil barrels, pork barrels, or cider barrels holding 50 to 60 gallons each are suitable. Much that has been said regarding fire pails applies to other containers.

WATER UNDER PRESSURE

A farm water system may be of real help in stopping a small fire, but to fight a well-started fire successfully requires more water and higher pressure than ordinarily can be had from such a system. A garden hose connected with a pressure system can be really effective on small fires, but its efficiency is limited by the capacity of the tank and the available pressure. For example, a water system with a capacity of 5 gallons a minute will not provide enough water for good operation of an ordinary ¾-inch garden hose. If there is an adequate pressure system on the farm, however, a long garden hose should be provided especially for use in fighting small fires. A stream, especially

in spray form, from such a system can be played upon a fire for a continuing period, whereas the extinguishing agent in the case of a fire extinguisher (except for a back-strap pump-tank extinguisher) usually lasts only about a minute.

A ladder should be kept handy so that full use can be made of the home water supply in case of roof fires. With 30 pounds pressure at the faucet, 50 feet of ¾-inch garden hose, and an ordinary $\frac{3}{16}$-inch nozzle, the discharge is 5 to 6 gallons a minute—only about 2 pailfuls. Such a stream directed at a large fire does little good, because it is dispersed by heat; and it may happen that no water reaches the right point. Other practical difficulties include frozen pipe lines, hose too short or defects in it, misplaced nozzles, and lack of experience in the skillful use of the equipment when the time comes to fight fire.

Although farm water systems are not generally given credit in insurance ratings, they may be of great value if a fire is discovered in its early stage, and it undoubtedly is wise, when a pressure system is installed, to provide a few well-placed hose connections. Farmers' Bulletin 1978, Safe Water for the Farm, describes in detail the installation of farm water systems.

Farmers who have motorized orchard spray rigs have found these machines to be rather effective in fighting farm fires. As they are equipped with high-pressure pumps and nozzles adapted to breaking the water into a fine spray or mist; only additional lengths of hose are usually needed to convert such equipment into effective fire-fighting units.

FIRE EXTINGUISHERS

Putting out a fire with the least damage depends upon early discovery and quick action. Portable extinguishers that contain a small quantity of water or other extinguishing agent are highly useful, but they are intended only for the control of fires in their early stages.

For convenience, fires have been classified according to the way in which they can best be extinguished in their early stages: Class A, fires in ordinary combustibles, like wood, paper, textiles, and rubbish; class B, fires in small quantities of flammable liquids, oils, and greases; and class C, fires in electrical equipment. Fires are commonly put out in two ways: (1) By cooling (quenching) the burning material below its burning temperature, and (2) by smothering the fire and depriving it of the air (oxygen) necessary to support it. Class A fires are best put out by cooling with water or water solutions. Class B fires are best put out by smothering. Class C fires introduce a third condition—that the stream applied be a nonconductor of electricity so it will not cause electrical shock or injury to the user.

Water is ordinarily not effective in fighting fires in flammable liquids. In fact, it may spread the burning liquid and make control of the fire more difficult. Water also is a conductor of electricity, so to put it on fires in electrical equipment may result in shock or injury.

Several types of effective extinguishers are suitable for use on farms. They are briefly described here. Unfortunately there is no extinguisher on the market today which is equally effective on all three classes of fires. The most important facts concerning the different types of fire extinguishers are summarized in the following tabulation.

Type of extinguisher	Use on fires of—			How to operate	Length of discharge	Recharge	Protection from freezing
	Class A	Class B	Class C				
PLAIN WATER							
					Feet		
Pump tank	Yes	No	No	Pump by hand	30–40	After use	Approved antifreeze chemicals may be added to the water.
Gas cartridge	Yes	No	No	Turn over, bump on ground.	30–40	do	
WATER AND CHEMICALS							
Soda-acid	Yes	No	No	Turn over	30–40	Annually	Keep in heated cabinet if building unheated; NEVER add antifreeze chemical.
Foam	Yes	Yes	No	do	30–40	do	
CHEMICAL							
Vaporizing liquid	No	Yes	Yes	Pump by hand	20–30	After use	None required to −50° F.
Carbon dioxide	No	Yes	Yes	Open valve at top	3–4	do	None required.
Dry chemical	No	Yes	Yes	do	8–12	do	Do.

Extinguishers Suitable for Class A Fires

Pump-tank type

The pump-tank extinguisher uses either plain water or a nonfreezing solution of calcium chloride as the extinguishing agent and comes in two principal sizes—2½ and 5 gallons. The tank is equipped with a pump for throwing the liquid 30 to 40 feet. If plain water is used, the extinguisher must be protected against freezing. Water for use in pump tanks can be protected from freezing by adding calcium chloride to the water in the following quantities:

Lowest Fahrenheit temperature at which mixture is protected from freezing:	*Pounds of calcium chloride added to 2 gallons of water*
10° above zero	4 pounds 7 ounces.
Zero	5 pounds 9 ounces.
10° below zero	7 pounds 6 ounces.
20° below zero	8 pounds 6 ounces.
30° below zero	9 pounds 2 ounces.
40° below zero	10 pounds 0 ounces.

Water so treated should not be used for any other purpose, and barrels or containers of it should be covered to prevent animals from drinking it.

This type of extinguisher should be kept full of liquid at all times, and it should be thoroughly cleaned at least once a year. The pump should be operated frequently, directing the liquid into the tank, and the pump parts should be kept well oiled or greased. This type of extinguisher is effective on small (class A) fires in wood, paper, textiles, rubbish, and other ordinary combustible materials. A pump-tank extinguisher that can be carried on the back is described under woods fires (p. 25).

Soda-acid type

The 2½-gallon is the most common size of soda-acid extinguisher. It is so made that it can be hung on a wall in any convenient place. Turning the extinguisher upside down from the position in which it hangs causes the soda solution and acid to mix, and this forms carbon

dioxide gas, the pressure of which expels the solution through the hose. The extinguishing value of the soda-acid stream, which has force to carry 30 to 40 feet, with the flow continuing about 1 minute, is practically the same as an equal quantity of water.

Larger soda-acid extinguishers (the most common sizes being 20 and 40 gallons) come on wheels. They are wheeled to the fire. They can discharge streams as high as about 50 feet, the stream lasting about 3 minutes. The wheeled type should prove worth while on larger farms and estates, for use in and around the barns or other main buildings.

Soda-acid extinguishers must be recharged each year, as well as immediately after any use. In winter they must be placed where the temperature remains above freezing. Salt or other antifreezing ingredients should not be added to the soda-acid type as this will interfere with the operation.

Soda-acid extinguishers are effective on small fires in wood, paper, textiles, rubbish, and other ordinary combustible materials.

Foam type

The foam extinguisher is another type of chemical fire-fighting equipment. The most common size holds 2½ gallons. Turning the extinguisher upside down causes two separately contained solutions to mix. Carbon dioxide gas is formed; its pressure expels from the extinguisher a foam of countless small bubbles filled with carbon dioxide gas. The foam can be discharged a distance of 30 to 40 feet for about 1 minute. It smothers the fire by clinging to the burning materials and excluding the air (oxygen) necessary to support combustion. As it contains a liberal quantity of water, the foam also has considerable cooling effect.

This type of extinguisher should be charged yearly as well as immediately after any use, with chemicals supplied by the manufacturer. It must be protected against freezing, but antifreezing ingredients should not be added. Before being recharged, all parts should be washed thoroughly. Foam extinguishers are particularly effective on small flammable liquid fires except where the liquid is moving; but they are also effective on small fires in wood, paper, textiles, and other ordinary combustible materials.

Extinguishers Suitable for Class B and C Fires

Vaporizing liquid (carbon tetrachloride base) pump-gun type

The type of extinguisher known as the vaporizing liquid pump-gun type, of which the most common sizes are of 1-quart and 1½-quart capacity, uses carbon tetrachloride which has been specially treated to lower the freezing point to −50° F., and to prevent corrosion. The liquid is forced out by working the pump with one hand while holding the extinguisher with the other. The stream can be thrown 20 to 25 feet, and the liquid can be expelled at the rate of a quart in 40 to 50 seconds, with average operation.

In using these extinguishers, especially in unventilated places like small rooms or closets, care should be taken to avoid as much as practicable the breathing of the vapors or gases that are produced.

This type of extinguisher should be partially discharged and refilled each year. No liquid except that furnished by the manufacturer

should be used. Ordinary carbon tetrachloride will not serve, as its freezing point has not been depressed and it corrodes the mechanism of the extinguisher.

The vaporizing-liquid extinguisher is effective on small fires of flammable liquids, oils, and greases, and on incipient fires in electrical equipment, where the use of a nonconducting extinguishing agent is of first importance.

Dry-chemical type

Extinguishers are available in which dry chemicals are used as the extinguishing agent. The chemical of this kind that is most commonly used consists of finely ground bicarbonate of soda that has been mixed with other ingredients to prevent caking. The mixture may be bought in bulk to refill the extinguishers at the scene of the fire. It is not damaged by extremes of heat, cold, or moisture.

Hand extinguishers holding from 15 to 30 pounds are available for dispensing the chemical, which is most effective on fires of flammable liquids and in electrical equipment. Smaller sizes are also available. The chemical is expelled from the extinguishers by pressure from a carbon-dioxide cartridge. A new cartridge is required at each powder refill, so extra cartridges should be stocked. These cartridges should be weighed annually as a check against leaks.

Carbon-dioxide type

The carbon-dioxide type of extinguisher contains carbon dioxide under high pressure. It cannot be recharged on the spot. Best results are obtained by applying the discharge as close to the fire as possible. As carbon dioxide is nonconducting, such extinguishers are suitable for fires in electrical equipment when provided with horns of nonconductive material, and may also be used on small flammable liquid fires.

An extinguisher of this type should be weighed at least annually to make sure that it is adequately filled. If the loss in weight is more than 10 percent of the rated capacity, it should be recharged.

Miscellaneous types

Several extinguishers are available which have not been listed or approved by the two best known testing laboratories, because of their limited fire-extinguishing capacities or for other reasons. Among these are the dry powder "shaker" units and the glass "grenade," containing either water or carbon tetrachloride. Such extinguishers are of value in some cases where they can be used on very small fires in their early stages.

OTHER MATERIAL AND DEVICES

Sand, Soil, and Soda-and-Sawdust

Sand or soil is useful in preventing fires by covering or absorbing spilled flammable liquids. It may also be used in putting out small isolated fires in flammable liquids on floors. To be effective in smothering such a fire, a heavy blanket of sand or soil must be put on quickly.

Sawdust, evenly mixed with sodium bicarbonate in the proportion of 10 pounds of soda to 1 bushel of sawdust, is effective on fires found

in small quantities of lubricating oils and greases in open containers or on floors, when the mixture is applied rapidly and is spread over the entire surface.

The sand, soil, and soda-and-sawdust should be supplemented by fire extinguishers.

WOODS FIRES ON FARMS

LOSS AND INJURY CAUSED BY WOODS FIRES

Fire is an enemy of thrifty and profitable woods. Ordinarily the deep spongy layer of leaves, twigs, and humus that covers the forest

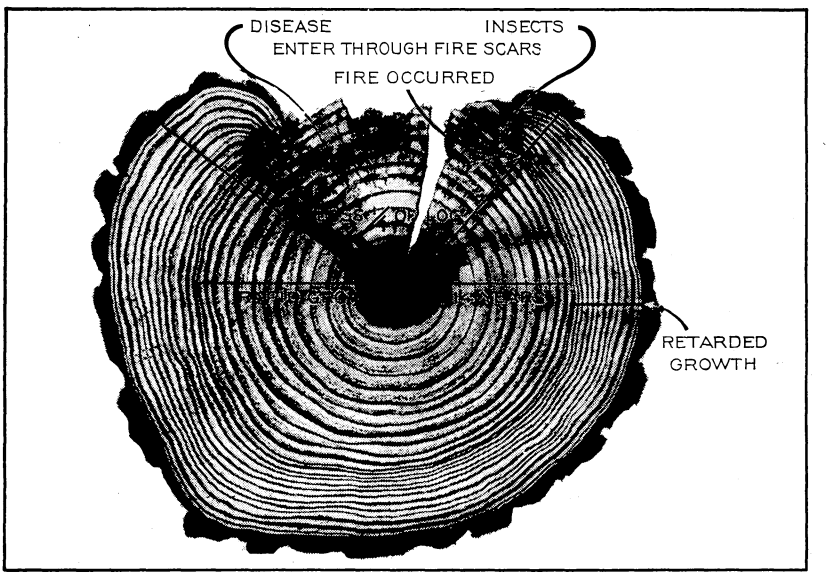


FIGURE 5.—A single light fire may kill the delicate cambium or living layer just beneath the inner bark, allowing fungi or wood-rotting disease to enter and greatly reduce the value of the tree. This picture shows the result of a fire that occurred in the tree's fourteenth year. After the fire, growth was retarded, and disease and insects gained entrance through the fire scar.

floor is a powerful aid in keeping the soil cooler in summer and warmer in winter than the surrounding soil. It also aids in conserving the moisture for the growing trees and for springs, and in checking soil erosion. But it is estimated that from 8 to 10 million acres of woodland on farms are burned over every year, destroying the protective litter and humus, and the seedlings or saplings to restock the lands. Fires also cause the loss or serious injury of mature valuable timber. This total woods loss is estimated at not less than $20,000,000 annually. Everybody loses when timber burns—the owner, the community, and the Nation.

A single light-surface fire may cause serious injury to trees that will go unnoticed for a year or more (fig. 5). Then the leaves will begin to turn brown because of secondary injury by insects or disease.

Burned and protected woodlands are contrasted in figures 6 and 7.

U. S. FOREST SERVICE 227104

FIGURE 6.—A thrifty stand of selected kinds of the most useful and valuable trees.

U. S. FOREST SERVICE 450655

FIGURE 7.—Complete destruction of all forest growth on wide tract.

CAUSES OF WOODS FIRES

Carelessness is usually the cause of woods fires. Often such fires are started when burning is being done to clean up tracts of new or old land, or they are set by smokers who do not extinguish matches or the tobacco in cigars, cigarettes, and pipes. A few fires may be set maliciously or, especially in the South, may be set by people who still think burning exterminates boll weevils, cattle ticks, and other insect enemies but experience over many years shows that burning the woods is not successful in getting rid of insect pests. At other times fires are set to bring on a growth of new, tender grass for cattle to graze but this is not done as much now as it was before fence laws were passed in certain States.

Some people feel no responsibility about stopping the burning at their property lines but let fires burn over other properties. Practically every State has laws covering such misconduct.

PREVENTING WOODS FIRES

Most woods fires on farms can be prevented if the right attitude toward fire hazards is maintained by the landowner and the tenant. Farmers, by their efforts, can generally keep their woodlands from burning. They can stimulate and lead public sentiment against the heavy loss that takes place when timber burns.

Some useful precautions are the posting of fire-warning notices, keeping a watchful lookout or patrol over the woodlands during dangerous fire periods, and maintaining firebreaks along dangerous boundary lines and interior firebreaks to connect vital points like streams, highways, or roads. Plowed firebreaks, like the one in figure 8, will usually stop a ground fire and in case of a serious fire will serve as a base for backfiring—a hazardous but sometimes advisable action.

Public sentiment against fires can be strengthened by both individual and collective educational effort. A full realization of the loss to the owners, the communities, and the country, caused by the wholesale destruction of living trees by fire, will go far in influencing thinking and actions. Education is a powerful agent. Poster and essay contests in the public schools and the showing of motion pictures and lantern slides are helpful.

FIGHTING WOODS FIRES

An average farmer has most of the equipment necessary to subdue and put out woods fires quickly. The use of buckets and barrels and pump extinguishers, as described previously, will help in subduing fire among trees and brush.

Water carried in barrels by wagon or truck and applied by hand sprinklers or by means of wet gunny sacks used as swatters will usually subdue the hottest grass and low-brush fires. The water-man must be quickly followed by a swatter or rake to smother or scrape all glowing material aside to avoid a quick rekindling of flames. Finally, a careful "mop-up" along the apparently deadened fire line is essential to prevent smouldering coals from breaking out. "Be sure your fire is dead out," is an excellent saying to keep in mind.

Rakes and shovels are used to clear a firebreak for stopping the flanks of fires. Or the firebreak may serve as a base for backfiring the

head of a fire, but this is a dangerous practice which should be used only in extreme emergency. The fire swatter is an effective and widely used fire tool. It consists of a piece of old belting about 2 feet long and 12 to 14 inches wide attached to a straight stick or handle. It can be used to swat and kill hot grass fires with a minimum of effort. Another popular tool is a rake consisting of about four sections or knives of a mowing-machine cutter bar, which rakes and cuts at the same time. Axes are always essential and, in larger timber, so are saws to cut down dangerous dry snags or to open up wider firebreaks. Night fire fighting is especially effective because normally there is not much wind and the dew or high moisture content of the air is helpful. There are many physical dangers in fighting a large brush or woods fire, so it is necessary to be watchful at all times.

A back-pack pump is effective. The pump itself is commonly of the trombone type, and the tank, fitted for convenient carrying on the

U. S. FOREST SERVICE 208226

FIGURE 8.—A few furrows plowed around standing timber will often stop ground fires or may be used as a base for backfiring when that dangerous action becomes advisable as a last resort in checking bad fires.

back, ordinarily holds 4 or 5 gallons of water. This pump is used extensively by the forest fire-control agencies (fig. 9). It is adapted to other uses on the farm, such as spraying orchard trees.

ORGANIZED WOODS- OR FOREST-FIRE CONTROL

Most of the State departments of forestry maintain efficient forest-fire organizations through which they aid woodland owners in fire prevention and suppression. The protection work is carried on by State Forestry Departments in cooperation with the Forest Service, United States Department of Agriculture, under provisions of section 2 of the Clarke-McNary Forestry Act. The forest landowner himself in some States pays a few cents per acre (usually 2 to 6 cents) and the county and the Federal Governments each pay a share in making

up the annual budget for fire prevention and suppression. The State is organized by natural districts, usually with counties as local units, and fire wardens, guards or rangers, and towermen are employed. Thousands of farmers who take part in these close-knit organizations benefit from forest protection at a small cost. Often the local county agricultural agent aids in keeping the members active. One primary

U. S. FOREST SERVICE 371158

FIGURE 9.—Men fighting a woods fire with back-pack, hand pumps, each holding 5 gallons of water. These are often called trombone pumps.

purpose of such cooperative mutual aid is to prevent fires, but the organization is geared to stop them as quickly as possible if they do occur.

COMMUNITY FIRE PROTECTION

Two types of safeguards have been described: (1) Elimination, so far as possible, of needless fire danger and (2) individual or home preparedness for extinguishing fires before they reach serious size. The third type of safeguard is community fire protection.

A well-equipped rural fire department frequently saves the building in which fire breaks out, with the possible exception of large barns. And in most cases it will prevent the fire from destroying other buildings and property on the place, thus substantially lessening the loss that otherwise would occur. Under favorable conditions even the barn or other building in which the fire originated may be saved from extensive damage. A manual that suggests ways for farm people in any neighborhood to use their knowledge, skill, manpower, and fire-fighting equipment more effectively has been published by the United

States Department of Agriculture as Miscellaneous Publication 612, Fire Fighting on Farms.

Assuming that the fire-fighting apparatus is efficient and that the department is well organized, trained, and maintained, its effectiveness in reducing fire losses on farms will depend upon several things, among which are promptness in giving the alarm, condition of roads, distance to be traveled, water supply on the farm for fire department use, and location of buildings with respect to one another. Remarkable strides in attaining more efficient farm fire protection have been made possible by the manufacture of light, water-carrying fire trucks as well as water-tank auxiliary trucks, by the construction of more all-weather roads, and by the extension of telephone services. Most States have official State programs for the instruction of volunteer firemen in the use of their equipment. Although their effectiveness is still limited in many instances by lack of these facilities, rural fire departments have a good record in communities where such facilities are available.

Fire-insurance rates have been reduced in some localities as a result of the development of community fire organizations. In some instances the rate credit for farmers served by a rural fire department has been conditioned upon the farmer's having a telephone and an approved water supply, and upon his farm being located not more than a specified distance from the fire station. A farmer may usually get an endorsement to his insurance policy, at a slight additional cost, under which his company agrees to pay for the cost of any run made to his farm by a fire-department truck. Such payments by insurance companies are a substantial source of income to volunteer fire departments in some areas.

There are two general types of rural community fire organizations. One is the voluntary-association type, either incorporated or unincorporated, by which farmers in a community band together to get service from a nearby city or village fire department. The other is the type by which fire protection is on a tax-supported basis.

Under the voluntary plan, farmers usually band together and buy a truck that is adapted to rural conditions, and place it in the care of a nearby city or village fire department to be used upon call by farmer subscribers. In other cases farmers join a voluntary association through which they pay fees to a nearby fire department. In many small communities volunteer fire departments are organized to serve not only the village but the surrounding countryside as well. Funds for buying the apparatus are often raised by public subscriptions. Carnivals and entertainments are frequently held to raise money to support a program.

Under the tax-supported type of program, many rural fire-protection districts have been formed, as well as to township and county fire departments (see p. 28). There are different methods of organizing and financing these programs. When the tax levy is small, officials may contract for fire-department services; or if equipment is bought, it may be manned by volunteer firemen to keep operating expenses low. In recent years, however, there has been a tendency to hire one or two full-time firemen who are responsible for keeping all equipment in good condition and for responding to calls.

LAWS ENCOURAGING ORGANIZED RURAL FIRE PROTECTION

In general, the laws covering the organization of **rural fire-protection districts** require a petition, by a specified number or percentage of the property owners in an area, describing the need for the protection and outlining the area proposed to be served, together with an estimate of the costs involved. This petition is presented to the appropriate county or township official. He usually calls a meeting at which those attending are given an opportunity to make objections and to offer suggestions for any alteration of the tentative boundaries. If not more than a specified fractional part (usually a fourth) of the resident property owners object, an election is called. If the proposal receives a majority vote, the district may be organized and incorporated. Usually from three to five commissioners or directors are elected to administer the program. Taxes are voted to provide funds with which to operate. A bond issue is usually permitted, upon election, but the amount and tax rate are generally limited by law. The proceeds from the bond issue are usually used to build the fire station, install an alarm system, and buy equipment.

The **county or township fire department,** on the other hand, is usually initiated and administered by local officials and is financed out of general tax receipts. The service is usually area-wide and follows existing boundaries. Such departments frequently can be established by decision of the proper county or township officials, without a referendum.

Rural fire-protection services have been undertaken in some form in most States. Legislation authorizing such services and outlining procedures for their establishment on a State-wide basis have been enacted in 38 States.[5] Laws under which rural fire-protection districts may be established to fit local conditions have been most popular. Such laws have been enacted in 26 States.[6] Township fire departments may be formed or the services of existing departments may be extended under the laws of 17 States.[7] Latest in point of time, have come the provisions, in the laws of 11 States, for the organization of county fire departments, under which services may be extended to all unprotected areas of a county.[8]

The laws of Michigan, Oklahoma, Wisconsin, and Wyoming authorize any of these three types of fire-protection organizations. Either rural fire-protection districts or county fire departments may be organized in California, Virginia, and Kentucky. Either rural fire districts or township fire departments may be organized in Kansas, Massachusetts, Pennsylvania, Connecticut, and New Jersey. Only

[5] States without such legislation are: Alabama, Arizona, Florida, Mississippi, New Mexico, Tennessee, South Carolina, and West Virginia. States without State-wide legislation but providing for rural fire-protection services under public local laws are Delaware and Maryland.

[6] Arkansas, California, Colorado, Connecticut, Idaho, Illinois, Kansas, Kentucky, Louisiana, Massachusetts, Michigan, Missouri, Montana, Nebraska, Nevada, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Vermont, Virginia, Washington, Wisconsin, and Wyoming.

[7] Connecticut, Indiana, Iowa, Kansas, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, North Dakota, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Wisconsin, and Wyoming.

[8] California, Georgia, Kentucky, Michigan, North Carolina, Oklahoma, Texas, Utah, Virginia, Wisconsin, and Wyoming.

county fire departments may be organized in Georgia, North Carolina, and Texas. Fire-protection districts only are authorized in Arkansas, Colorado, Idaho, Illinois, Louisiana, Missouri, Montana, Nebraska, Nevada, New York, Ohio, Oregon, Washington, and Vermont. Only township fire departments are authorized in Indiana, Iowa, Maine, Minnesota, New Hampshire, North Dakota, Rhode Island, and South Dakota.

DEVELOPMENTS IN VARIOUS STATES

The practice of providing organized rural fire protection under some plan has been spreading rapidly. State and community officials, Chambers of Commerce, farm organizations, and insurance companies are helping to promote interest in rural fire protection. Through the educational influence of farm meetings and fire-prevention drives, information on the need for organized fire protection, on how to organize, and on proper fire-fighting equipment, is being distributed to farmers to acquaint them with the essential facts and assist them in protecting their property against fire. It is not surprising that the number of rural communities that have some form of organized and specially equipped fire-protection service runs into the thousands.

Complete information on farm fire departments or service is not available for all States, but the following general statement is based on information supplied by State fire marshals, insurance commissioners, and others.

In *California* at least 250 fire-protection districts have been organized, some on a county-unit basis. In *Illinois* about 140 rural fire protection districts have been organized; of these, 27 are recognized for the purpose of reducing the rates of fire insurance. In a recent study of 75 fire departments that provide rural protection, it was found that a fourth were supported by taxes not in excess of 1¼ mills on assessed valuations; 10 were cooperatives; 2 were maintained by donations; 10 were municipally owned; and the remainder were maintained by combinations of these arrangements. In *Iowa* about 486 of the 675 fire departments respond to rural fire calls and about 150 rural fire-department trucks have been bought through taxation, subscription, or donation. In *Minnesota* part or all of at least 208 townships have fire-department protection. In *Nebraska* about 30 rural fire protection districts have been organized. In *New York* about 1,324 fire districts have been organized, also a State association of such districts. In *North Dakota* the rural sections of at least 150 townships have some protection.

In *Oregon* at least 104 fire protection districts have been organized. They serve an average area of nearly 30 square miles. Almost a third of them provide their own fire department services; the rest contract with nearby municipal fire departments for rural protection. Five districts contract for their service personnel but supply their own equipment. The average fire-protection tax is about 3.6 mills. Of the 104 districts, 47 have been approved for reduction in the rates of fire insurance. In *Washington* there are approximately 100 fire-protection districts, of which 14 have been approved for rate reductions in insurance on standing grain.

RURAL FIRE TRUCKS

Two principal types of motorized fire apparatus are suitable for farm and rural fire-protection service. One is what is known as a triple combination pumping car, having a pump, a fire-hose body carrying 2½-inch hose, and chemical or water-tank equipment. The pumps have a capacity of 300 to 1,000 gallons per minute and are designed to pump water from any water supply that may be available, such as hydrant, cistern, tank, brook, or pond. The chemical or water-tank equipment supplies a small stream for a limited time.

The other type of apparatus does not primarily depend on supplies of water at the scene of the fire but carries a large water tank with a small pump and necessary hose and other equipment, or carries a multiple-tank chemical unit. This type of apparatus is also extensively and effectively used by State, county, and town forestry organizations in fighting forest or woods fires.

A guide for rural communities wishing to buy efficient motorized fire-fighting apparatus, which gives standards for rural fire equipment and outlines certain minimum requirements of fire-department organization, has been prepared by the Farm Fire Protection committee of the National Fire Protection Association, in which committee the United States Department of Agriculture is represented. This report also contains a model ordinance and rules for a volunteer fire department and a model State law for establishing fire-protection districts and for providing fire protection. This material has been published as a bulletin called "Volunteer Fire Departments for Rural and Small Community Service (1947)," by the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass.

WATER SUPPLIES

The two most valuable contributions to successful fire fighting by rural departments are probably an adequate supplementary water supply on the farm and all-weather roads. Motorized fire apparatus carrying either chemical tanks or water tanks, or both, can cope only with fires of limited extent on farms, unless they can get additional water. Rural fire departments commonly use a ½-inch nozzle which requires about 50 gallons of water a minute (3,000 gallons per hour) for an effective fire stream. Enough water supply for at least 1 hour's pumping should be available.

Where a stream or pond with dependable supply is within a few hundred feet of farm buildings, the problem of additional water is simple. It is necessary only to furnish easy access to the supply for the fire-department pumper. The pond may need to be deepened or the stream dammed to make a pool from which suction can be taken. Such ponds or streams may be made attractive, and are often of practical value for livestock watering or other productive purposes.

Where no natural supply is available, additional storage of water can be provided by an underground tank or cistern. Plans for making cisterns are distributed by the Portland Cement Association, 33 West Grand Avenue, Chicago 10, Ill. Moreover, a few building-supply dealers are furnishing wooden forms for a standard-size cistern for use by those who buy cement. It is desirable to make the full capacity of the tank or reservoir at least 3,000 gallons, to allow

for the tank not being full at all times. The tank should be centrally located and have a suitable manhole opening for a suction hose. Regular inspection to see that the tank is full should be made. Elevated tanks which are part of the domestic water system may be used if of sufficient capacity and if a suitable hydrant or other connection is provided for the pumper. Before any reservoir is abandoned or destroyed, consideration should be given to its use in connection with fire fighting. Fish ponds, if not located too far from buildings, should also be of value in such plans.

The Farm Fire Protection committee prepared a report, Water Supplies for Fire Protection on Farms, which is published as a bulletin by the National Fire Protection Association. It suggests ways and means for the most efficient utilization of available water supplies in extinguishing farm fires and mentions certain essential features that should be provided to give reasonably adequate fire protection when new water systems are installed. The pamphlet "Water Systems for Rural Fire Protection" is also available from the National Fire Protection Association.

"Wet" Water

Recently it was found that when certain chemicals were mixed with water, usually in the proportions of about 1 gallon to 100 gallons of water, the water was made much more effective in extinguishing fires where deep penetration is required. Fires on which water so treated was used were put out more quickly and with considerably less water than would otherwise have been required. The effect is most pronounced in the case of fires in baled cotton, baled or loose hay, and similar substances. Water treated with these chemicals, which are sold under various trade names, is known as "wet" water. It would seem practicable for rural fire departments to use the treated water in tank trucks which may accompany the rural fire trucks. The treated water, like ordinary water, would have to be protected from freezing.

CONCLUDING STATEMENT

No practical application of fire safeguards either by the individual or by the community or State, or by all combined, will entirely eliminate the possibility of loss by fire. But the probability of such loss on a given farm can be greatly lessened, and the aggregate of the annual losses for any larger group or for all American farms can be greatly reduced from its present total. This should mean correspondingly reduced cost of insurance protection against such few losses as may occur and correspondingly greater personal safety to a farmer and his family.

The burning of a farm building worth $4,800 means to an owner who has no insurance that he himself loses that amount. To the owner of such a building who has his property insured to the usual extent of about three-fourths of its value, it means that the insurance company loses about $3,600 and he himself loses the remaining $1,200. In addition, as in the case of the uninsured owner, he suffers the inconvenience or loss of being without the building until it can be replaced. Regardless of whether the property was insured or not, the country as a whole is poorer by the $4,800 represented by the building that was

burned unless a part of the insurance was carried in a foreign insurance company. In that case it would still be true that mankind is poorer by the full amount of the loss.

Insurance is indispensable to the individual who wishes to play safe. But insurance does not create wealth to replace that which is lost. It merely distributes the loss, or a greater part of it, over a group of individuals. It is no real substitute for fire prevention and fire protection from the viewpoint of the honest insured or from the viewpoint of civilized society. This general truth applies to farmers as much as to any other group. Reasonable fire safeguards for the farm in the form of proper fire-prevention measures, simple but effective home fire-fighting equipment, and organized rural fire protection, are essential to rural progress and safety.

U. S. GOVERNMENT PRINTING OFFICE: 1949

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 15 cents